



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

AMS

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/056,154 | 01/23/2002 | Vincent Fortin | M12524 US | 2279 |

7590

08/14/2002

Michael Purcell
SKJERVEN MORRILL MacPHERSON LLP
Suite 700
25 Metro Drive
San Jose, CA 95110-1349

EXAMINER

LEE, HSIEN MING

ART UNIT PAPER NUMBER

2823

DATE MAILED: 08/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/056,154

Applicant(s)

FORTIN ET AL.

Examiner

Hsien-Ming Lee

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☒ Claim(s) 1 and 6 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claim 1 is objected to because of the following informalities: at line 1, "tha" should -- that --. Also in claim 1, there has limitation redundancy, i.e. titanium is formed by ionized physical vapor deposition, at lines 5-6 and 10.

Claim 6, " The method of Claim 7" should be -- The method of Claim 5 --.
Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 3 recites the limitation "the titanium target" in line 14. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blair (US 6,136,705) in view of Cerio (US 6,268,284).

Regarding claims 1 and 4, Blair teaches the claimed method for forming cobalt silicide on a body 110 which has a surface that comprises silicon (Fig.4), the method comprising:

- forming a cobalt layer 118 on the surface (Fig.5);

Art Unit: 2823

- forming a titanium layer 120 (thickness : 50~200 Å) over the cobalt layer 118 (Fig.6);
- reacting the cobalt layer 118 with the silicon 110 to form cobalt silicide 122/124/126 (Fig.8) and
- removing the titanium layer 120 and un-reacted cobalt layer 118 (Fig.9).

Blair fails to teach utilizing an ionized physical vapor deposition (IPVD) for forming the titanium layer. However, using the IPVD for forming titanium layer is a well-known method, as evidenced by Cerio (abstract). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to utilize the IPVD as taught by Cerio for forming the titanium layer of Blair since this deposition method would provide a better wetting layer for subsequent deposition and improve layer thickness control (see abstract).

Regarding claims 2 and 3, the selections of AC power and the distance between the target and the body are obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). In such situation, applicant must show that the particular range is critical, generally by showing that the claimed range achieve unexpected results. See M.P.E.P. 2144.05 III.

6. Claim 5 is are rejected under 35 U.S.C. 103(a) as being unpatentable over Blair ('705) in view of Cerio ('284) as applied to claims 1-4 above, and further in view of Venkatesan et al. (US 5,863,598).

The combined teachings of Blair and Cerio substantially teach the claimed method except that the silicon surface is located at a bottom of an opening having aspect ratio of at least 2.5. Venkatesan et al. teach forming a high-aspect-ratio contact having a silicon layer 112 filling in an opening having aspect ratio of at least 2.5 (Fig. 1c and col. 1, lines 20-22; col.3, lines 46-49). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to form the layers of Blair and Cerio, including the silicon body, the cobalt layer and the titanium layer using the IPVD method as stated above, in the high-aspect-ratio contact structure as taught by Venkatesan since by doing so it would provide a contact structure having a good coverage without void formation.

7. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blair ('705) in view of Cerio ('284) and Venkatesan et al. ('598) as applied to claims 1-5 above, and further in view of Givens (US 2002/0019127).

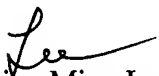
The combined teachings of Blair ('705), Cerio ('284) and Venkatesan et al. ('598) still fail to teach that at least part of a sidewall surface of the opening is made of a dielectric. Givens, in a method of forming a high-aspect-ratio contact, teaches forming a high-aspect ratio opening 18 in a dielectric layer 16 formed on a substrate 12 (Fig.5); forming a cobalt layer 30 in the opening 18 (fig.5); and forming a cobalt silicide 32 in the opening 18 (Fig.9). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to form the cobalt silicide of Blair, Cerio and Venkatesan et al. in the high-aspect-ratio opening as taught by Givens, wherein the opening is formed in the dielectric layer having the sidewall, since by doing so it would provide a good electrical insulation between the substrate and the subsequent layers formed on the dielectric layer.

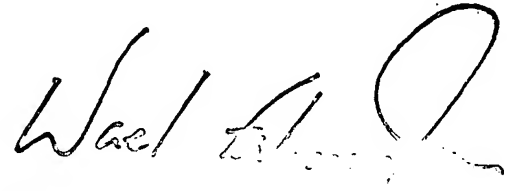
Art Unit: 2823

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-0142 for regular communications and 703-305-0142 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Hsien Ming Lee
August 8, 2002


SUPERVISORY PRIMARY EXAMINER
TECHNOLOGY CENTER 2000